

Landscape Planning & Tick Management

A Residential Perspective



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Promoting Community IPM for Preventing Tick-Borne Diseases
EPA Conference
29-30 March 2011, Arlington, VA

Tick Management

- Personal Protection Measures
- *Habitat or landscape modifications*
- Biological & natural control
- Area-wide chemical control
- Host reduction or exclusion
- Host-targeted acaricides
- Host-targeted vaccines



Tick Management Handbook

An integrated guide for homeowners, pest control operators, and public health officials for the prevention of tick-associated disease

Revised Edition

Prepared by:

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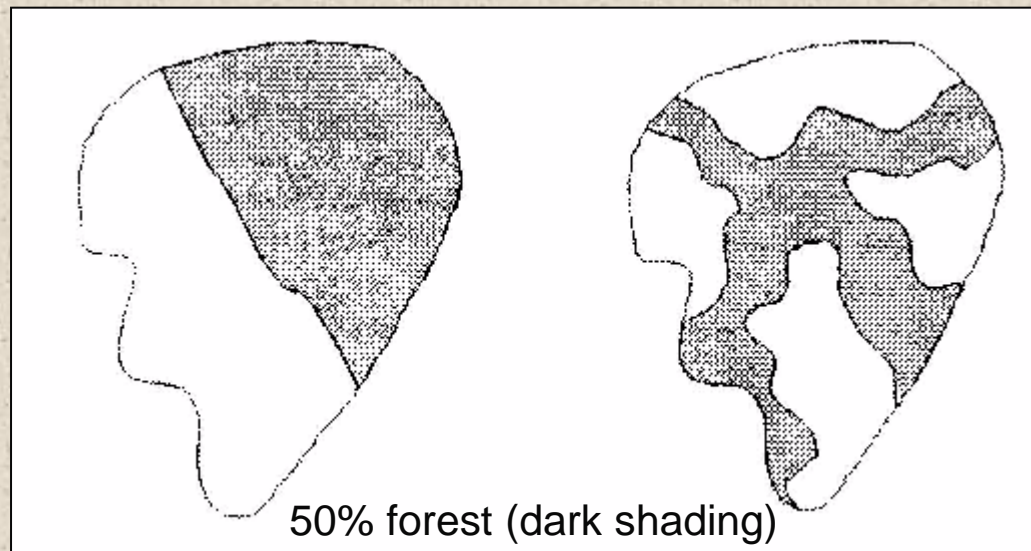
Towards landscape design guidelines for reducing Lyme disease risk

Laura E Jackson,^{1*} Elizabeth D Hilborn¹ and James C Thomas²

- Emergence of Lyme disease has been linked to reforestation and suburbanization that expose humans to habitat and hosts that favor *Ixodes scapularis*.
- Many studies have linked forest edge (reviewed Killilea et al. 2008) and lower host diversity (LoGiudice et al. 2003, etc.) (favoring deer and white-footed mice) with the risk of Lyme disease.
- Authors examined LD incidence and land-cover metrics for 12 counties in Maryland.



- LD incidence rate most explained by edge-contrast index, a measure of forest-herbaceous edge plus larger percent forest cover.
- Two landscapes with 50% forest cover, but different forest & edge interspersions (below). Figure on right with high forest & edge interspersions offers more shelter-foraging opportunities deer and mice and access suburban and rural residents – features that would increase peridomestic exposure.



Lyme disease risk is linked to peridomestic exposure

Distribution *Ixodes scapularis* home environment:

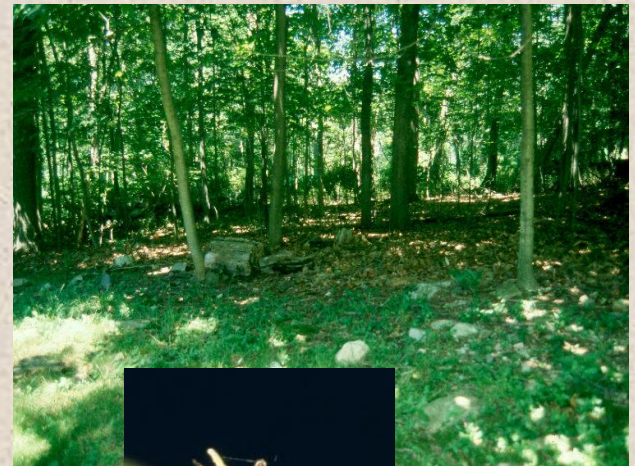
- 67.3% woods, 21.6% ecotone, 2% on the lawn
- 82% nymphs are within 3-m of the lawn edge with woods, stone walls, ecotone, etc.

Maupin et al. 1991; Stafford & Magnarelli 1993; Carroll et al. 1992

Risk linked to peridomestic activity:

- Estimated 75% ticks are picked up outdoors at home
- Indicated activity: Play 47%; Yard work 18%; Gardening 12%; Elsewhere neighborhood 4%

Data: Stamford Health Department





New Tactics In War On Ticks

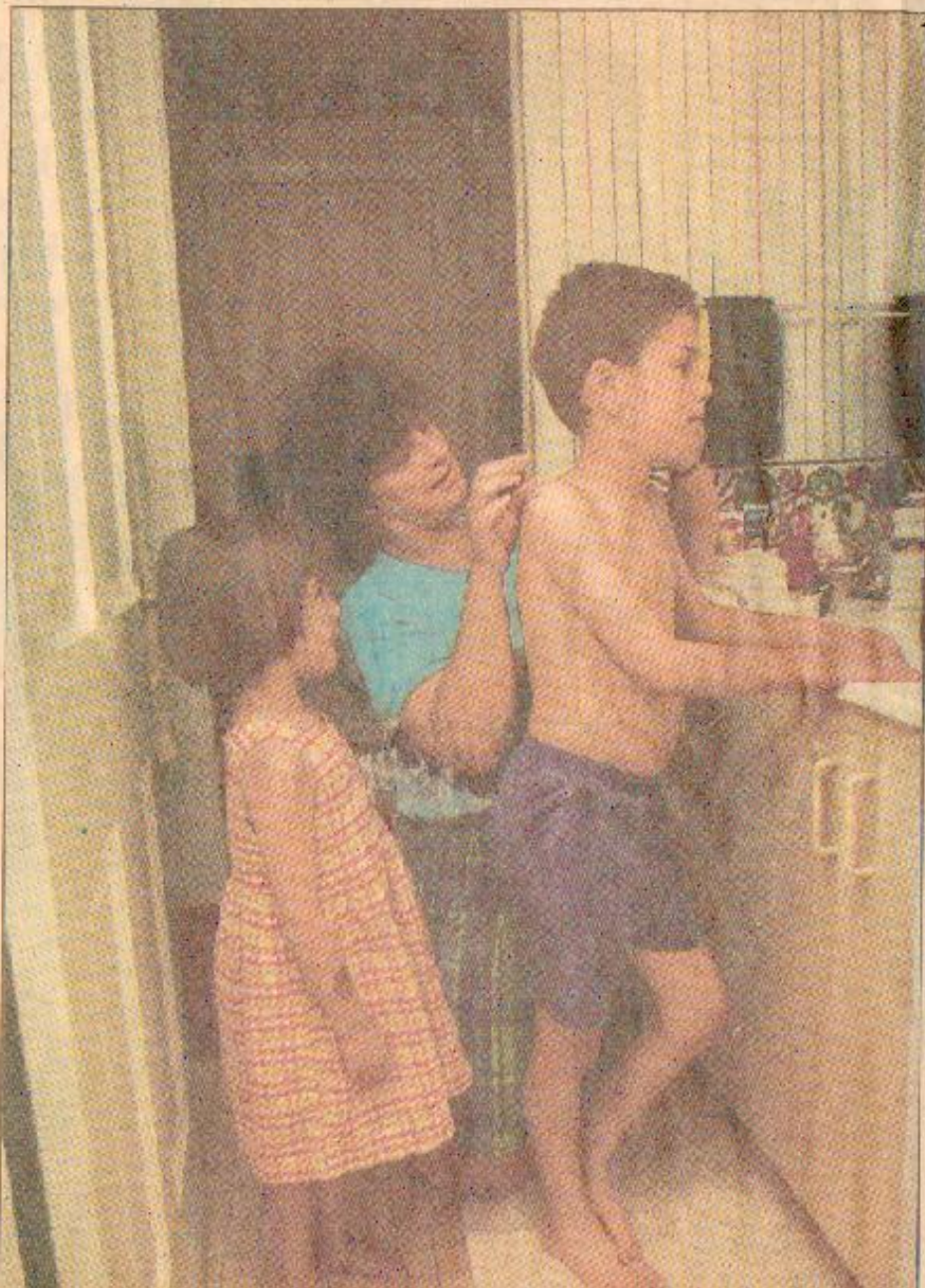
*As Pest's Population Grows,
Researchers Invade Yards
With Toxins, Rakes, Mulch*

By STEVE GRANT
Courant Staff Writer

OLD LYME — In front of Jeanna Berryman's home is a cluster of white pine, oak and sassafras trees, a snippet of woods that helps give the property its country charm, and its danger.

Deer often roam among the trees.

"It's kind of neat sometimes to see them out there, but used to be more neat when I wasn't worried about ticks," Berryman said. "It used to be a lot more fun to see



Hartford Courant June 20, 1998



WWW.CT.GOV/CAES

Residential Landscape Management

Mowing, pruning

Clearing brush

Restrict groundcover

Leaf litter removal

Landscape barriers

Deer fencing

Deer resistant plantings



K. Stafford





**Laboratory evaluation of desiccants
and insecticidal soap applied to various substrates
to control the deer tick *Ixodes scapularis***

LISA A. PATRICAN and SANDRA A. ALLAN* Department of Entomology,
Cornell University, Ithaca, New York, and *Department of Infectious Diseases, College of Veterinary Medicine,
University of Florida, Gainesville, Florida, U.S.A.

Med. Vet. Entomol. 1995. 9:293-299



412

Journal of Vector Ecology

December 2006

**Response of nymphal *Ixodes scapularis*, the primary tick vector of Lyme disease
spirochetes in North America, to barriers derived from wood products or related
home and garden items**

Joseph Piesman

J. Vector Ecol. 2006. 31:412-417

- Insecticidal soap and silical gel with pyrethrin & PBO provided 78-100% control nymphal ticks pachysandra, sod, stones or woodchips.
- Alaska yellow cedar sawdust or woodchips and cellulose acted as barriers to nymphal tick movement, but only the sawdust impeded crossing up to 1 month.

Leaf Litter Removal



Yard Edge 49-70% reduction



Clean-up Stone Walls

Landscape Barriers



Yard Edge 35-77% reduction



Reduce Groundcover





From 1999-2002, three CT health districts initiated intensive community-based intervention programs to increase awareness of Lyme disease and encourage use of prevention measures

CUTTING DOWN ON LYME DISEASE



Members of the Weston Kiwanis Club Jack Light, left, and Reg Bowden, holding weed wacker, and Weston Selectman Woody Bliss clear an area at the Weston Historical Society Thursday to create a Target Lyme Disease demonstration site.

Healthy landscaping, deer-tick prevention to be taught at Coley homestead site

By HARRIET HILLER
Hour Staff Writer

WESTON The Weston Historical Society has agreed to be a good neighbor and permit the Westport-Weston Health District to transform the property around the Coley homestead, the society's headquarters on almost four acres, into a Target Lyme Disease demonstration site.

The grounds will be turned into an outdoor learning exhibit, a self-guided walking tour, which will show homeowners how to landscape and manage their property in such a way as to help keep deer ticks away.

To combat deer ticks, the Westport-Weston Health District applied for and received a Target Lyme Disease grant, funded by the Center for Dis-



Bob Atkinson of Weston helps clear brush to make way for the demonstration site.

ease project director, said the main goal is to prevent Lyme disease from happening in the first place. "Our idea is to mobilize the community and

and preparing garden beds. Deer-resistant gardens will be planted by the Weston Gardener Club using "old-fashioned" flowers that were the vogue in the 19th century.

Students from Weston High School, as a community service project, were busy weeding and taping the men at work on the property.

"This is the perfect place to use for this project — it is on a main road with wonderful access and people can come in and get out easily," Traugh said. "The historical society was very agreeable because they want to bring people here to appreciate this historic property. We want to bring the community here. Anyone who is interested in working it help prevent Lyme disease is welcome to call and volunteer. There is a role for everybody."

In addition to clearing the site, project, and we are now in the process of turning this into a demonstration site where people will be able to see a number of different landscaping techniques they might adapt to their yards to keep deer

Tick Off Kickoff Targets Lyme Disease

BY DON CASCIATO
dscasciato@bennet.com

With the help of a talking tick, which already is pushing its message on area radio stations, a campaign was launched Wednesday by the Westport-Weston Health District to alert area residents about the Lyme disease threat that lurks in their backyards and beyond.

"We want to tick off everybody we care about," says the tick in the introduction of the radio advertisement. The tick then talks about the pain and risks of Lyme disease.

History might remember the start of the campaign which started Wednesday with a press conference at the district's office at 180 Bayberry Lane and a meeting at Weston Town Hall in the evening as the "Tick Off Kickoff."

Unlike football kickoffs, the goals of the Tick off are to focus on fields and towns to make everyone as safe as possible from tick attacks although there are no sure things in fighting the blood-sucking critters.

continued on page A14



Kirby Stafford of the Connecticut Agricultural Experiment Station, points out things homeowners can do to protect their families from ticks like clearing leaf litter and removing ticks from property.

A14

WESTPORT NEWS, FRIDAY, MARCH 23, 2001

Tick off Those Ticks

continued from page A1
Cases Increase

Julia Nelson, the director of the Westport-Weston Health District, released preliminary data of the number infected last year in Connecticut. "As of tallies of March 23, the number is up substantially," she said. There were 754 cases or 114 per 100,000 of population, with 1,331 in Fairfield County. There were about 160 cases in 2000 in Westport and Weston.

The results indicate a trend westward from Southeastern Connecticut although it still is a problem in Old Lyme and places in the area of Old Saybrook and New London. "The highest state rates now are in Litchfield County," she said.

Right now there is an education component, demonstrations and discussions about whether the Lyme disease vaccine is "right or wrong," according to Sue Bokone, the district health educator.

The campaign goal is to cu-

vice Westport and Weston homeowners to take action for control and prevention against Lyme disease.

The strategy emphasizes direct personal contact and distribution of relevant handouts that will specifically:

- Demonstrate and alert people to the real and present dangers from Lyme disease by using ads and press releases by local media outlets.

- Illustrate proper landscaping techniques, by distributing Lyme disease brochures, offering buttons which read "Tick Off Your Friends" and "Tick Off Your Teacher" and providing displays in libraries, town halls, and other local places.

- Provide instruction in supportive measures to be supported by mass media the first and last weeks of the marketing campaign which runs until April 9.

In addition, pre-campaign letters were sent to every organiza-

Demo Planned

On April 21 at the Weston Historical Society there will be a demonstration during a walking tour on how to do landscaping effectively. Suggestions include clearing wood chips to establish a wood chip barrier, keeping grass cut short, removing leaf litter, brush and weeds at the edge of the lawn and making sure swing sets aren't left under a tree where ticks could fall on children.

"Children are a high-risk group," said Kirby C. Stafford, III, the chief scientist at the Connecticut Agricultural Experiment Station, who attended the press conference. "The greatest incidence of the disease is with children. We have to get people to think about what we do."

Joseph Plesman, the chief of the Lyme disease vector section of the National Center for Infectious Diseases, Mr. Nelson and Mr. Stafford discussed the importance of creating a tick safe zone in backyards of Westport and Weston.



Westport News photo: David A. Green Weston. Staff step don't eliminate the risk, but do reduce the chances of getting Lyme disease. A rodent bait box was demonstrated by Mr. Stafford and might become a future tool in the battle when production starts. A course visits to eat the bait and while in the box, contacts tick-fighting chemicals in the box. When a leaves ticks will avoid the rodents for up to seven weeks.

Although deer are the hosts to

Joseph Plesman of the Center for Disease Control and Prevention describes the relationship between Lyme disease and the White-footed mouse that ticks attach to or a mouse from which the ticks derive because infected.

ticks they have nothing to do with the Lyme disease infection. Mr. Stafford explained that the mice and other rodents are the source of Lyme disease and called "reservoir hosts." "Ticks are not born with Lyme," he said. "But the numbers continue to increase."

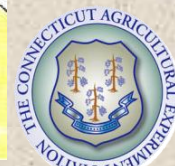
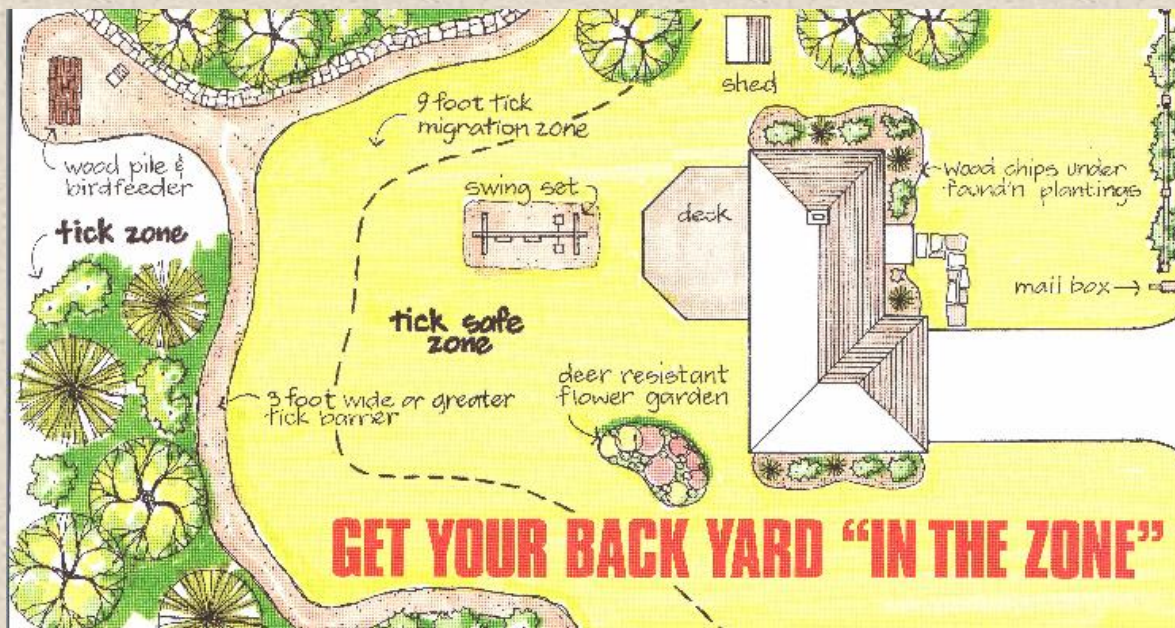
In response to a suggestion that deer be exterminated, Mr. Stafford replied: "It isn't a viable option. It is clear it would have to be a viral eradication."

Mr. Plesman added: "We need to get the whole community

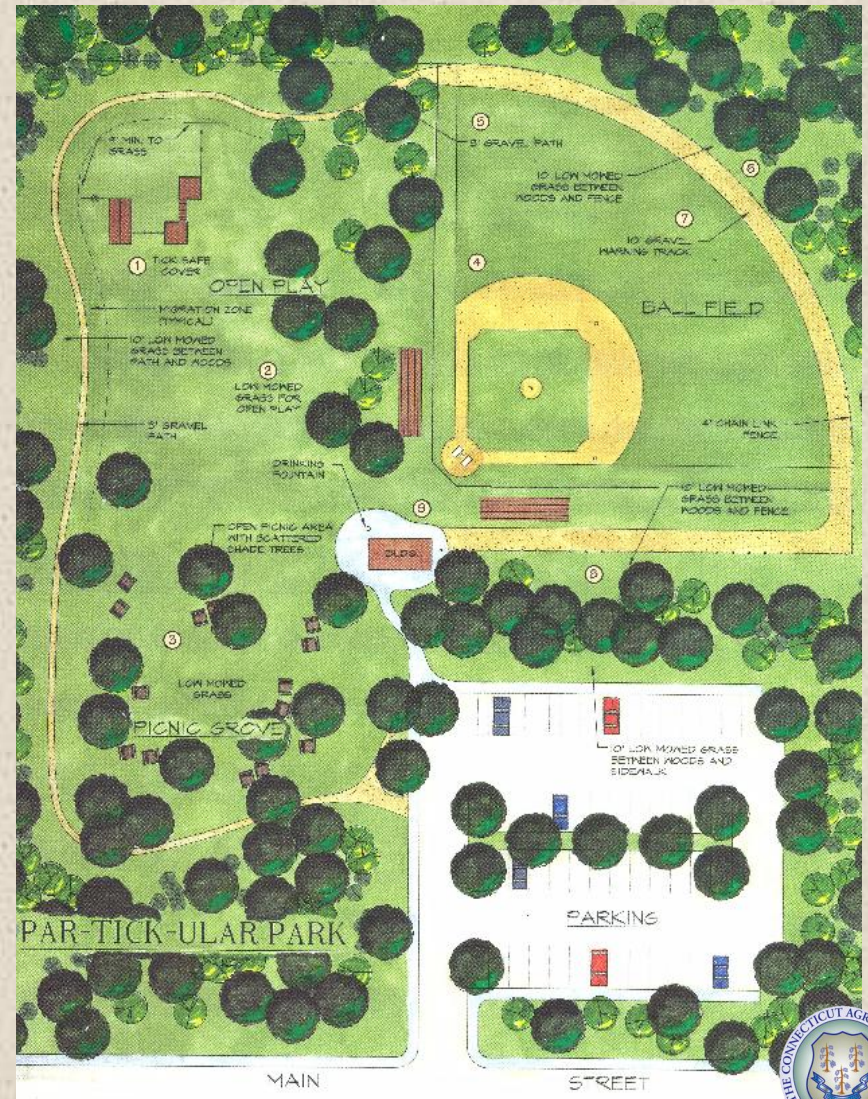
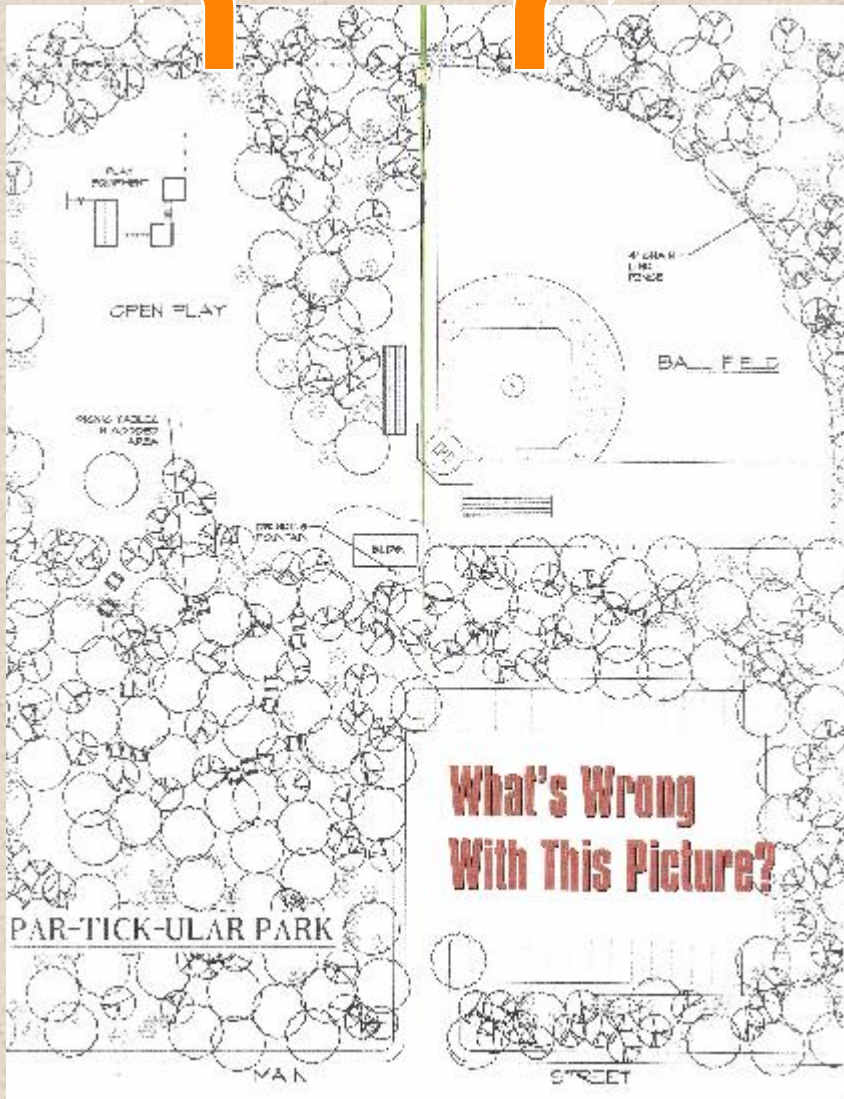
The Hour (Norwalk), Friday, June 23, 2000

The Westport News, Friday, March 23, 2001





Landscape Brochure



A photograph of a wooden play structure with a yellow slide, situated in a grassy area with trees in the background. The structure is made of light-colored wood and has a yellow slide on the right side. It is surrounded by green grass and trees.



© 2000 Produced by the Assegaat Vision Board Council,
Assegaat, Connecticut. Government Agricultural Experiment
Station and Western Delaware, Landscape Architectural Land
Rock Company. Supported by the Connecticut Department of Public
Health and the Centers for Disease Control and Prevention.

When developing locations for parks, fields and recreational areas, consider the following landscaping techniques:

③ Place picnic tables and play equipment in the sun and away from the woods.

④ Place fields/play areas as far away from the woods and stone walls as possible.

5 Create a wide lawn buffer between the playing field and woodland, stone wall or unmanaged edge. If the field butts up against high meadows or wooded areas, place a 9-foot-wide woodchip or gravel buffer between the field and the woods edge. Properly maintained, a xerix barrier makes it more difficult for the ticks to migrate from the woods to the field and serves as a visible reminder that a child or adult is entering a potentially tick infested area.

⑥ On smaller fields adjacent to woods, consider enclosing the recreational area with a four foot chain link fence. Keep the area between the fence and woods well maintained.

7 Surround perimeters of recreational fields or walkways with a 9-foot gravel warning track. Ground covers such as pachysandra or ivy should not be used, as mice and other small animals that carry ticks seek shelter in ground covers.

Ⓟ Place fields/play areas away from ponds and wetlands, and breeding sites for mosquitoes and other insects that can carry disease.

⑨ **Landscape using deer-resistant plantings.** Do not attract deer to the recreational area by planting flowers, shrubs and trees that they like to eat. Although no plant is completely resistant to deer damage, some plants are more susceptible than others. Lists of deer-resistant plantings are available from your local garden center, nursery, or from the Connecticut Agricultural Experiment Station (CAES).¹

396 U.S. 430 (1970), cert. denied, 400 U.S. 961 (1970).

Has quite a few "tick safe" design ideas for parks, playgrounds, gardens, fields, and recreational areas.

Recreational, school, and residential landscape characteristics can influence the risk of exposure to deer ticks (*Ixodes scapularis*). Lyme disease and other tick-borne diseases. Deer ticks live in the woods, sustained by their animal hosts (white-footed mice, chipmunks and deer), and the higher humidity levels of the woodland. Lyme disease cases are highly correlated with the activity of infected nymphal ticks and 71% of cases occur in the summer. The tiny nymphal deer tick makes its home in the leaf litter that accumulates on the forest floor, around stone walls, and under ground covers.

① A "tick safe zone" is composed of lawn, as sunny as possible, and begins nine feet or more from the edge of the woods or meadows. It should surround fields, playgrounds, recreational areas, and schools adjacent to buildings, and encompass the areas that are regularly used. This includes walkways, eating and entertainment areas, storage areas and gardens. The tick safe zone takes advantage of the tick's own biology and behavior to keep ticks away from frequently used areas and reduce tick numbers.

You can reduce the number of deer ticks on playing fields and recreational areas by the way you design the landscape. Placing fields, playgrounds, and recreational areas as far away from the woods and meadows as possible can significantly reduce the number of children and adults exposed to ticks at the edges of the fields. Ticks are unlikely to be encountered on open playing fields, but are picked up walking to the field, chasing balls into the edges, or standing or playing at field edges. Think about "landscaping the edge."²

Salinas, G. J., 1976. *El Mito del Desarrollo Económico en las Américas*. Siglo Veintiuno Editores, México.

Knowledge, Attitudes, and Behaviors Regarding Lyme Disease Prevention Among Connecticut Residents, 1999–2004

Vector-borne & Zoonotic Dis. 2008. 8:769-776

L. Hannah Gould,¹ Randall S. Nelson,² Kevin S. Griffith,¹ Edward B. Hayes,¹ Joseph Piesman,¹
Paul S. Mead,¹ and Matthew L. Cartter²

- KAB survey 1999, 2002, 2004 in three CT health districts
- In WWHD, use all environmental measures increased from 1999 to 2002 and were sustained as of 2004.
- Most respondents willing remove brush or leaf litter (91%) or place wood chip or gravel barriers (82%).
- Fewer willing to use deer fences (52%) or spray pesticide (47%).
- 44% willing to spend up to \$100, 37% spend more than \$100.



Peridomestic Lyme Disease Prevention

Results of a Population-Based Case–Control Study

Neeta P. Connally, PhD, Amanda J. Durante, PhD, Kimberly M. Yousey-Hindes, MPH, James I. Meek, MPH, Randall S. Nelson, DVM, Robert Heimer, PhD

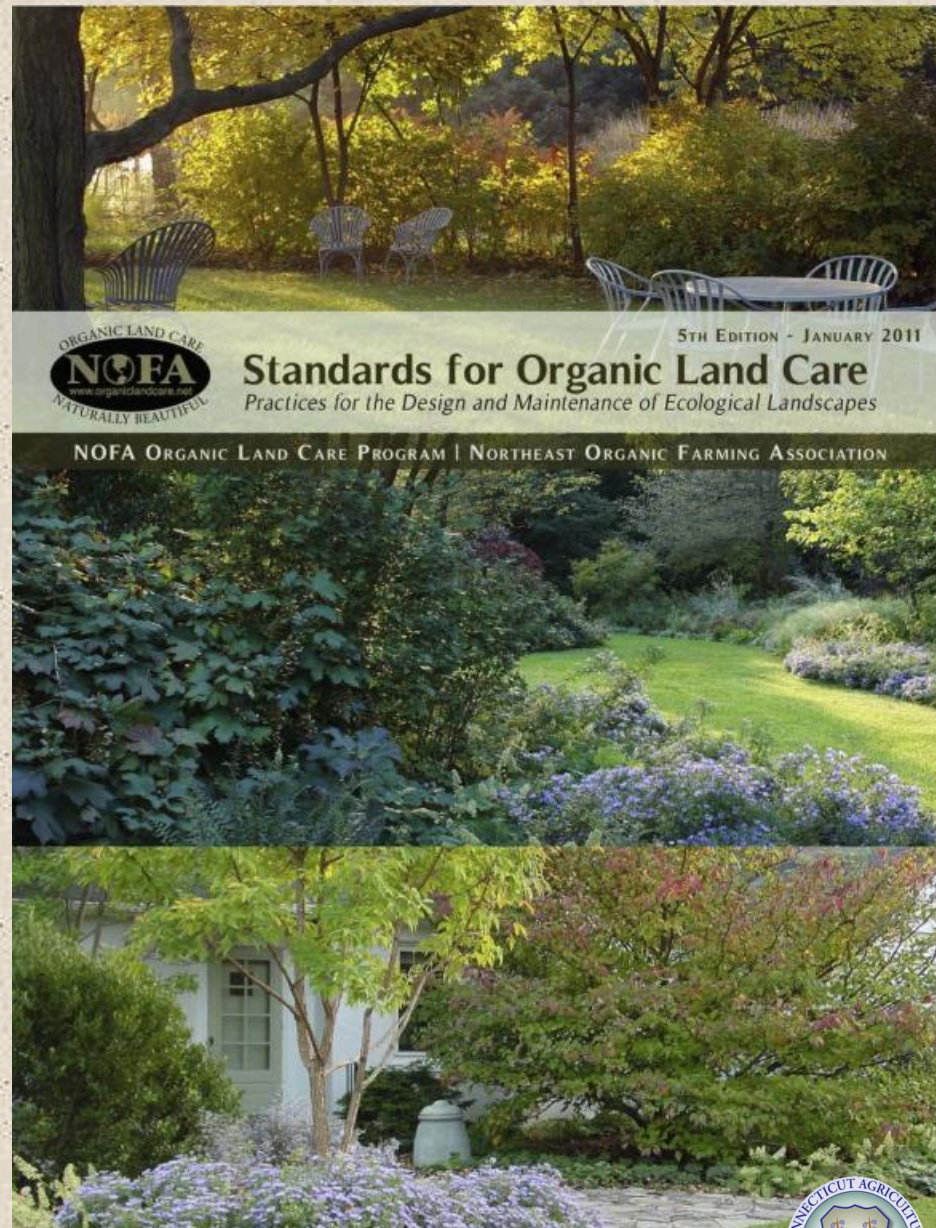
Am. J. Prev. Med. 2009. 37:201-206

- Examined personal protection, landscape modification, and chemical control in a prospective case-control study in CT.
- Checking for ticks within 36 hours of time in the yard was protective against LD.
- Bathing within 2 hours of time in the yard was protective.
- Fencing of any type was protective, but mechanism unclear.
- No other landscape modifications (mowing, leaf litter clearing, presence of playscapes, mulch or gravel barrier) were protective.
- Having stone wall, birdfeeders, vegetable garden, woods adjacent to property made no difference between cases and control (sample size also small in some cases).



NOFA Standards for Organic Land Care

- This is the heart of the Organic Land Care Program
- Provides a definition of “organic” in land care
- This definition is used for educational purposes (course, public outreach)
- Also specifies materials and practices that professionals pledge to use in providing organic land care to their clients



Tick (Pest) Management

NOFA Standards Organic Land Care

- Preferred

Tick bite prevention (avoid tick areas, pants in socks, repellents?)

Tick checks to detect and remove before pathogen transmission

Environmental modifications (landscape practices)

Host management (deer fencing & herbal, soap, human hair as repellents)

- Allowed

Biological agents (parasites & pathogens)

Diatomaceous earth & insecticidal soaps

Botanical insecticides, including plant extracts, such as pyrethrum and minimum-risk or 25b insecticides (Section 25b FIFRA), which are exempt Federal registration and do not have to demonstrate efficacy

- Prohibited

All synthetic insecticides and piperonyl butoxide as an insecticide synergist

Any pesticide formulated with any inert ingredient not allowed by the National Organic Program.

Ticks and Invasive Plants

Lyme disease incidence is high in many states where Japanese barberry, *Berberis thunbergii*, is reported invasive.



Light blue – states and provinces with barberry (<http://plants.usda.gov>)

Red – state where barberry reported invasive (<http://www.nps.gov>)

Blue dots – reported cases of Lyme disease in 2006 (<http://www.cdc.gov>)



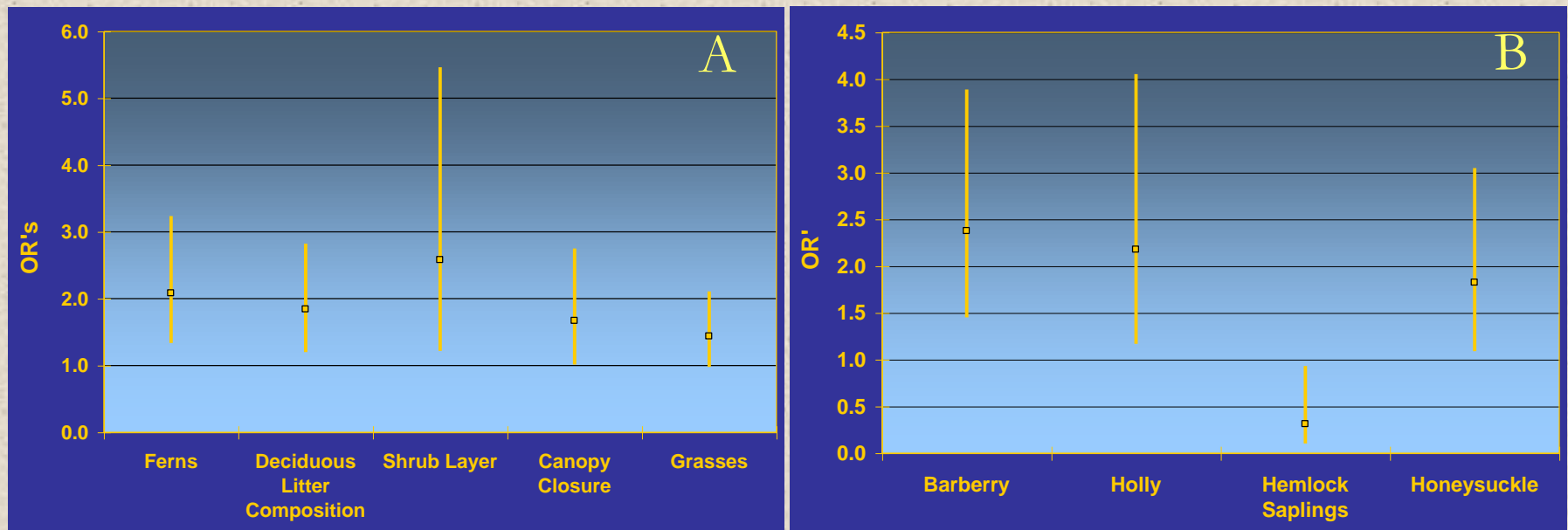
Habitat Associations of *Ixodes scapularis* (Acari: Ixodidae) in Maine

CHARLES B. LUBELCZYK,¹ SUSAN P. ELIAS, PETER W. RAND, MARY S. HOLMAN,
ELEANOR H. LACOMBE, AND ROBERT P. SMITH, JR.

Lyme Disease Research Laboratory, Maine Medical Center Research Institute, 13 Charles Street, Portland, ME 04102

Environ. Entomol. 2004. 33:900-906

Odds ratio & 95% CI associating *I. scapularis* with habitat (A) and specific plant species (B)



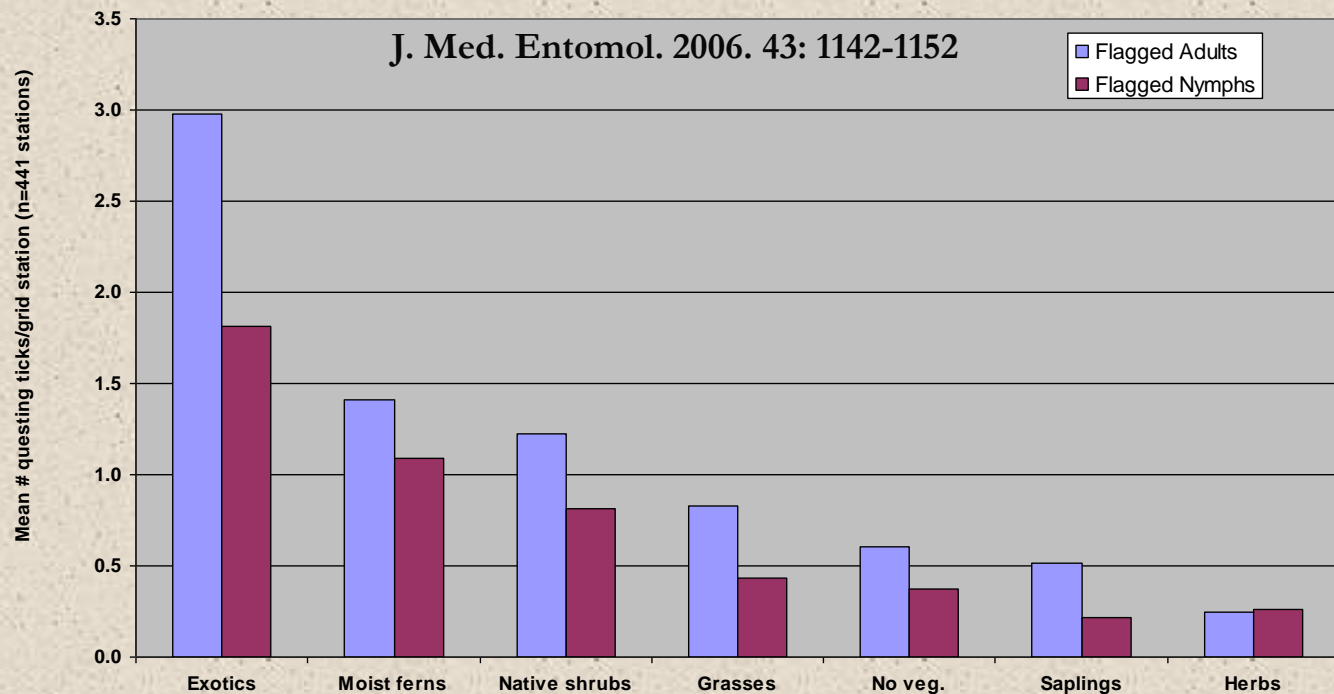


Deer Browse Resistant Exotic-Invasive Understory: An Indicator of Elevated Human Risk of Exposure to *Ixodes scapularis* (Acari: Ixodidae) in Southern Coastal Maine Woodlands

SUSAN P. ELIAS,¹ CHARLES B. LUBELCZYK, PETER W. RAND, ELEANOR H. LACOMBE,
MARY S. HOLMAN, AND ROBERT P. SMITH, JR.

Maine Medical Center Research Institute, Vector-Borne Disease Research Laboratory, 75 John Roberts Road, Suite 9B,
South Portland, ME 04106

Higher tick counts associated with exotic invasive forest understory than native forest understory or open understory forests.





Barberry Control and Ticks

COMMUNITY AND ECOSYSTEM ECOLOGY

Managing Japanese Barberry (*Ranunculales: Berberidaceae*)
Infestations Reduces Blacklegged Tick (*Acari: Ixodidae*)
Abundance and Infection Prevalence With *Borrelia burgdorferi*
(*Spirochaetales: Spirochaetaceae*)

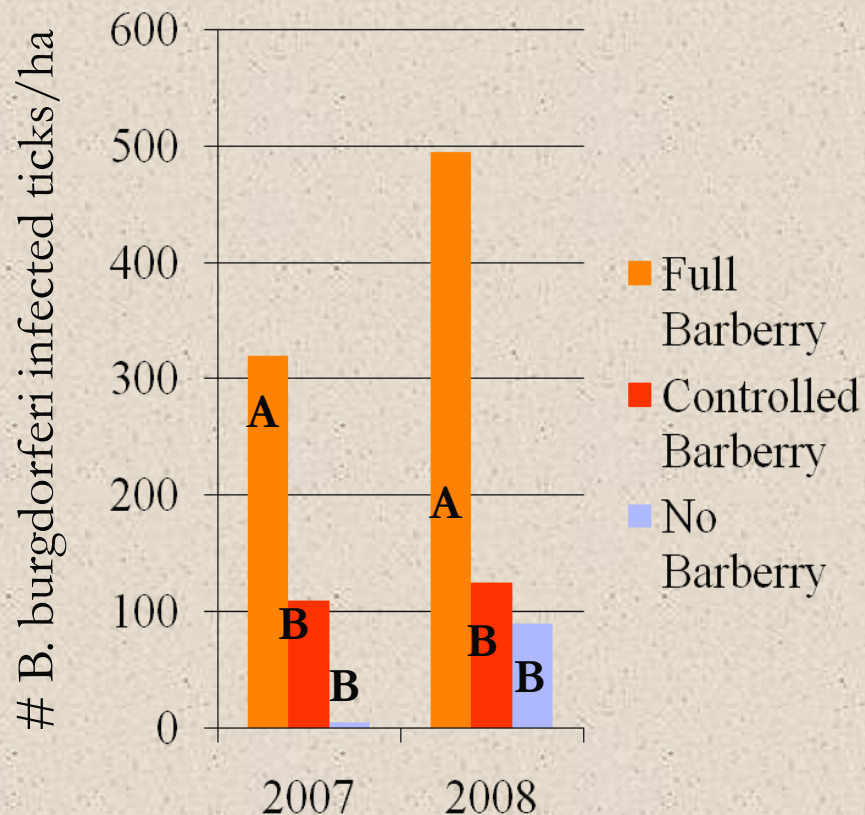
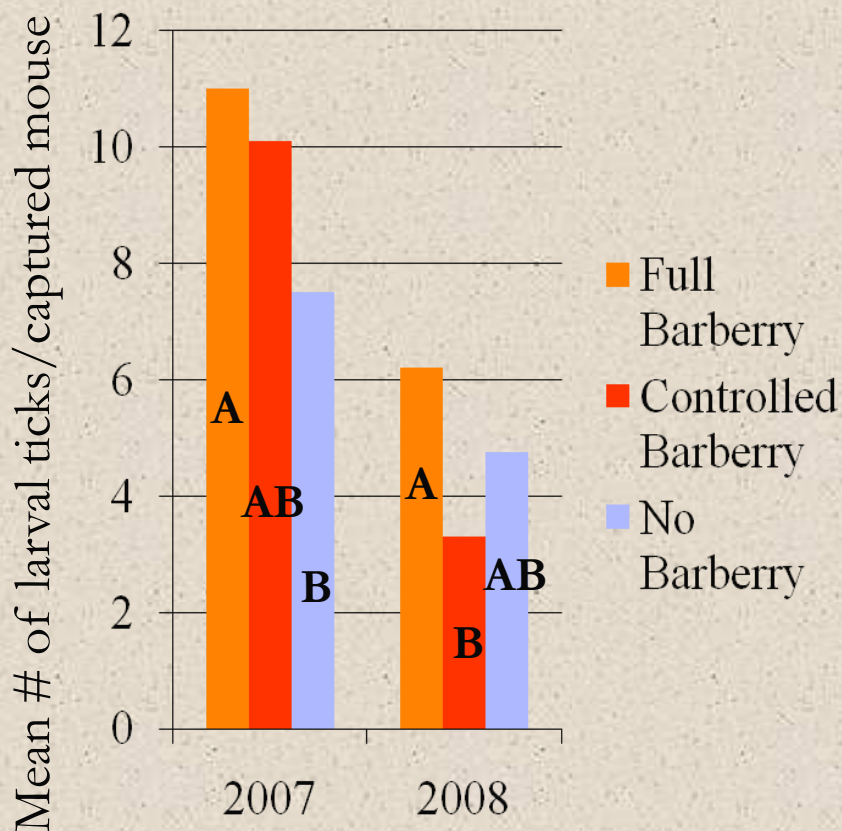
SCOTT C. WILLIAMS,^{1,2} JEFFREY S. WARD,¹ THOMAS E. WORTHLEY,³
AND KIRBY C. STAFFORD III⁴

Environ. Entomol. 2009. 38:977-984

- Barberry infested 40-70% sites and was reduced from 62% of cover to 3% cover by mechanical cutting and burning with propane in controlled areas in 3 sites in CT
- Questing adult blacklegged tick abundance greatest in areas Japanese barberry
- Greater abundance larval ticks on mice in barberry
- Larval ticks sig. fewer in 2008 in controlled areas



Barberry Control and Ticks





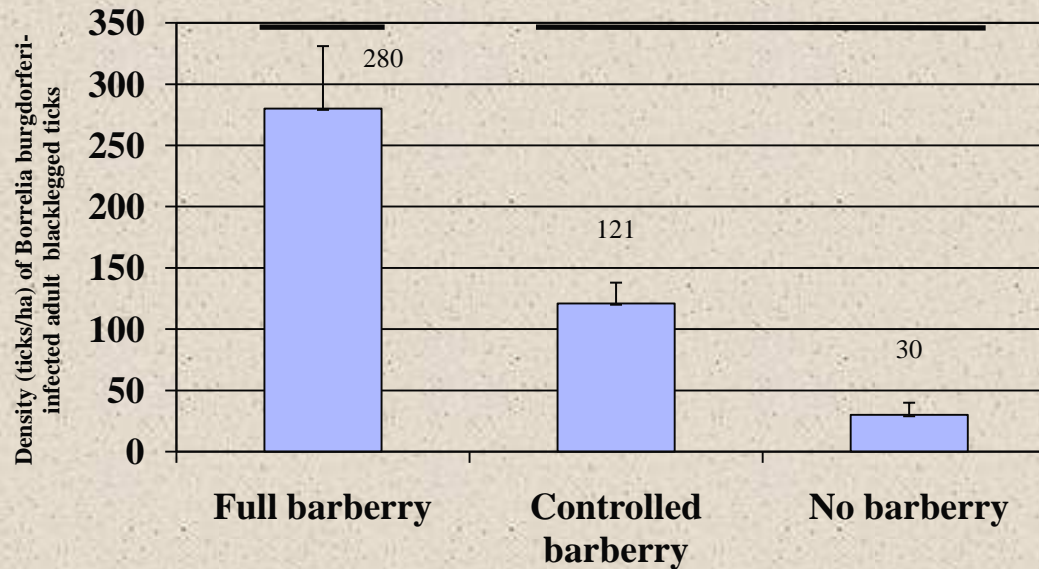
PLANT-INSECT INTERACTIONS

Effects of Japanese Barberry (*Ranunculales: Berberidaceae*) Removal
and Resulting Microclimatic Changes on *Ixodes scapularis*
(Acari: Ixodidae) Abundances in Connecticut, USA

SCOTT C. WILLIAMS¹ AND JEFFREY S. WARD

The Connecticut Agricultural Experiment Station, Department of Forestry and Horticulture,
PO Box 1106, New Haven, CT 06504

Environ. Entomol. 2010. 39:1911-1921



Barberry Management. Questing adult blacklegged tick abundance was greatest in areas with Japanese barberry. This invasive plant provides suitable habitat for the tick and rodent hosts. Managing Japanese barberry significantly reduced the density of spirochete infected ticks to nearly 60% of that of unmanaged infestations.



What fits within an organic or least-toxic tick management framework?

- Personal prevention measures and tick checks.
- Landscape management practices.
- Deer fencing, resistant plantings, and accepted repellents.
- Pyrethrin insecticides (limited effectiveness w/o PBO) with desiccants and insecticidal soap
- Biological (*Metarhizium* should be an option by 2012).
- Botanical compounds, plant essential oils.
- Host-targeted insecticides much better environmentally, but chemicals used are not organic (permethrin, fipronil).
Limited use to date.

Where do we go from here?

Panel Discussion

- How can we engage the landscape design professions in the prevention of tick-borne diseases?
- What is the best way to provide information on tick-borne disease prevention to professional planners and landscape architects?
- How can landscape design foster both conservation and prevention of tick-borne disease?

Entomopathogenic Fungi



VECTOR CONTROL, PEST MANAGEMENT, RESISTANCE, REPELLENTS

Field Applications of Entomopathogenic Fungi *Beauveria bassiana* and *Metarhizium anisopliae* F52 (Hypocreales: Clavicipitaceae) for the Control of *Ixodes scapularis* (Acari: Ixodidae)

KIRBY C. STAFFORD III¹ AND SANDRA A. ALLAN²

J. Med. Entomol. 2010. 47: 1107-1115



VECTOR CONTROL, PEST MANAGEMENT, RESISTANCE, REPELLENTS

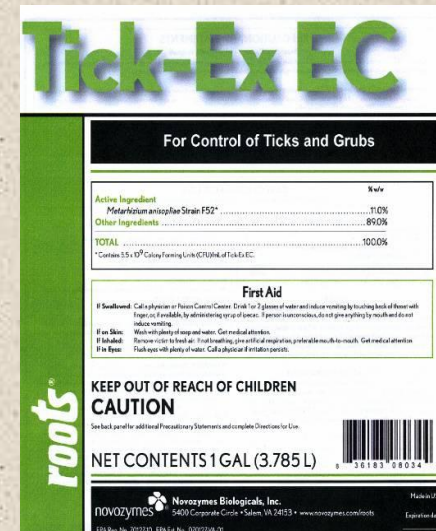
Evaluation of *Metarhizium anisopliae* Strain F52 (Hypocreales: Clavicipitaceae) for Control of *Ixodes scapularis* (Acari: Ixodidae)

ANUJA BHARADWAJ¹ AND KIRBY C. STAFFORD III

The Connecticut Agricultural Experiment Station, 123 Huntington Street – Box 1106, New Haven, CT 06504

J. Med. Entomol. 2010. 47: 862-867

Applications of *Beauveria bassiana* provided 38-75% control of the blacklegged tick, while *Metarhizium anisopliae* F52 (Tick-Ex) provided 53-74% control at the lower rate evaluated.



Natural Compounds for Tick Control

Nootkatone (Alaska yellow cedar, grapefruit)

CT studies 2008-2010, 100% control was observed for up to 4 wks post application 1st year, 80% in 2nd year with lignin-encapsulated nootkatone. Due to volatility, < 2-4% nootkatone remained by 1 week posttreatment.



MEDICAL ENTOMOLOGY

Ability of Two Natural Products, Nootkatone and Carvacrol, to Suppress *Ixodes scapularis* and *Amblyomma americanum* (Acari: Ixodidae) in a Lyme Disease Endemic Area of New Jersey

MARC C. DOLAN,^{1,2} ROBERT A. JORDAN,³ TERRY L. SCHULZE,^{3,4} CHRISTOPHER J. SCHULZE,⁴
MARK CORNELL MANNING,⁵ DANIEL RUFFOLO,⁵ JASON P. SCHMIDT,¹ JOSEPH PIESMAN,¹
AND JOSEPH J. KARCHESY⁶

J. Econ. Entomol. 209. 102: 2316-2324

NJ studies 2006 & 2008, 100% control was observed for 1-2 days, 82-88% after 7-10 days postapplication. A high pressure spray resulted in 98-100% control at 42 d post-application.

Minimum Risk Pesticides

- Minimum-risk pesticides exempt by EPA under Section 25b FIFRA

1. **Mosquito Barrier** (99.3% Garlic Juice)

2. **EcoEXEMPT IC2** (10% rosemary oil)



SHORT COMMUNICATION

Trial of a Minimal-Risk Botanical Compound to Control the Vector Tick of Lyme Disease

PETER W. RAND,^{1,2} ELEANOR H. LACOMBE,¹ SUSAN P. ELIAS,¹ CHARLES B. LUBELCZYK,¹
THEODORE ST. AMAND,³ AND ROBERT P. SMITH, JR.¹

J. Med. Entomol. 2010. 47: 695-698

- Garlic in our 2009 and 2010 trials appeared to suppress or control tick activity for 2-3 weeks. No nymphs and few adult ticks were recovered 1-2 weeks post-application with EcoEXEMPT in Maine studies in 2008.

